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A preliminary Contribution to a Knowledge of the Hydnaceae

BY H. J. BANKER

It is the purpose of the present paper to review our knowledge of the American mesopus forms of the genus *Hydnum*, with a view to call attention to these plants and prepare the way for an ultimate thorough revision of the group. In the present chaotic state of our knowledge of these plants, accuracy in the discrimination of species or in the formulation of a synopsis is often impossible; it is hoped, however, that the paper may be found of some service to the field botanist. The writer has found himself greatly hampered in his work by the difficulty of obtaining sufficient material for his purpose. It has seemed best, therefore, to prepare this contribution, imperfect though it must be, to encourage the coöperation of collectors in the accumulation of material and notes for a more thorough study of the group. Thus far the work has been based to a great extent on herbarium material, which, particularly in the fleshy forms, has proven very unsatisfactory. It is important that the plants should be studied in the living condition and ample notes made of their characteristics. Unquestionably there are many species at present confounded under a single name. This seems especially the case with *H. imbricatum*, *H. ferrugineum*, and *H. zonatum*. It is probable that this is due partly to the scattered and inaccessible character of the literature on this group but chiefly, doubtless, to the fact that the forms have not received a careful comparative study, which can only be accomplished with the aid of an abundance of material supplemented by excellent field notes. It will therefore, be pertinent to present a few suggestions concerning the field work.

I. COLLECTION

The Hydnaceae are to be found almost everywhere, but more especially in woodlands. The mesopus forms are nearly all terrestrial, while the other forms are as universally lignatile. The plants are readily recognized by the characteristic feature of the hymenial surface being in the form of awl-shaped spines projecting downward. In other respects the mesopus forms, that is, those having a central stem, resemble the ordinary toadstools. In collecting, plenty of material should be gathered that every variation of the plant may be shown. No collector should be satisfied with a half dozen plants if more can be obtained; scrappy collections have been the bane of mycologists. The entire plant should be removed, including if possible a portion of the substratum. Plants of different collecting should be kept separate, even if believed to be of the same species. A good way to protect them is to lay down a piece of tissue paper and, piling the plants in the middle, fold the paper carefully around them and deposit in a basket or collecting case. The author generally uses paper bags into which the plants can be easily slipped and, if liable to injury, can be removed by tearing the bag. In putting up material in this way it is a good plan to select one of the best plants and, taking a piece of colored paper, tear a hole in it through which the stem may be passed and then slip the paper up close to the pileus; the plant may then be wrapped up with its fellows. When the time comes to care for the specimens this paper will usually be found to furnish a very good spore print. The paper in which the plants are wrapped should be marked to correspond to the field notes.

II. PRESERVATION

The fleshy forms are especially subject to decay and should be cared for the same day as collected if possible, while none should be left more than twenty-four hours. The tough or woody species and resupinate forms may be very well preserved by rapid drying in a current of hot air. An excellent method is to suspend them in a wire basket over a stove where they may be heated as much as possible without danger of scorching. This will insure the destruction of insects, eggs and larvae. If then placed in small paper boxes, or, if not intended immediately for the herbarium, in tight paper bags with a few moth balls, they will be practically safe from these ravagers.

The fleshy species will undergo a greater change in this process of drying, sometimes so great as to be wholly unrecognizable; it is, therefore, necessary in addition to make special preparations of one or two specimens. This may be done by (1) Cutting a vertical slice through center of pileus and stem; (2) Half the remaining pileus is placed right side up, the other half with the under side up; (3) The remainder of the stem is placed with its outer surface uppermost, and the plant thus spread out is pressed and dried between dryers as in the case of a flowering plant, but with less pressure.

A spore print should be obtained in every case where it is possible. This should be taken on a square of plain paper, light or dark colored, in contrast with the color of the spores. The print may be obtained in two ways: (1) As indicated above under "Collection"; this will give excellent results as to color of spores and does not injure the plant; but (2) If a typical spore print is desired, the stem should be cut from the plant close to the under surface of the pileus, and the latter placed with the hymenial surface downward, on a sheet of paper of the proper color and then protected from draughts by inverting a bell glass or tumbler over it. The spore print may be permanently fixed by spraying with a solution of white shellac in alcohol by means of an atomizer.

III. NOTES

As there is no convenient method of preserving these plants in a fresh condition, good field notes become of the utmost importance. In fact, specimens without accompanying notes are oftentimes practically worthless.

On finding a plant or group of plants, there should be noted first, the environment and character of substratum, the growth habit, whether solitary, scattered, grouped, or cespitose. Then the plant itself should be examined and all its features carefully noted: the color whether varied or uniform; size of plant, giving actual dimensions; form of pileus and character of surface; in the scaly species the character and size of scales should be carefully determined; form and character of stem; texture of plant and structure of the interior should be fully described; color and character of teeth, whether coarse, fine, long, short, giving actual dimensions as far as possible; the color of the spores is important, as is also their size, form, and markings, but this will require the use of a compound microscope; the odor, when fresh and also in process of drying, and the taste are quite important; change of color in the fresh specimen when bruised or cut should be looked for; color and character of the juice of the plant should be observed; while even the character of the insect and other animal life for which it may furnish pabulum is not unworthy of the botanist's attention. Special care must be taken to keep the specimens and notes numbered to correspond correctly.*

In the following synopsis several species included in the notes will be found to be omitted. This is for the reason that an attempt to arrange them in synoptical form at present would be only guess work. Most of these, however, are included in the *species dubiae* and it is doubtful if they are really American species. On the other hand, there are a number of plants met with in the herbaria and, therefore, very likely to be found again in nature, which have heretofore been referred erroneously to known species; no attempt has been made to provide for these in the synopsis as their characters are too little known and it is quite probable that they will prove to be undescribed species.

There has been no attempt to adjust the taxonomic relations of the group, nor has its nomenclature been disturbed even where it is known that changes must be made: but the iconography and exsiccati have been given quite fully as these may be of value to those who have access to large collections and libraries.

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* Very helpful and more complete instructions in the collection and preservation of all kinds of fungi have been published in the following works: **Burt**, On Collecting and Preparing fleshy Fungi for the Herbarium. Bot. Gaz. **25**: 172–186. *pl. 14.* 1898. **Underwood**, Moulds, Mildews, and Mushrooms, 201–206. 1899. **Atkinson**, Mushrooms, edible, poisonous, etc. 222–229. 1900.

Synopsis of Species

- Lignatile ; small, 2 cm. wide ; dark green throughout. 1. *H. atro-viride.*
- Terrestrial.
  - Substance of pileus fleshy, brittle.
    - Bright colored, white, yellow, or orange.
      - White ; spores small, less than 6 μ wide.
        - Plant small, less than 3 cm. wide. 3. *H. albidum.*
        - Plant larger, more than 5 cm. wide. 4. *H. albo-magnum.*
      - Buff or yellow ; spores more than 5 μ wide.
        - Teeth decurrent.
          - Plant solitary. 5. *H. Washingtonianum.*
          - Plants cespitose, flesh turning yellow when cut. 6. *H. caespitosum.*
        - Teeth not decurrent or but slightly so. 2. *H. repandum.*
        - Pileus cracked and split. 7. *H. diffractum.*
    - Dull colored, fuscous, ferruginous, or gray.
      - Pileus smooth.
        - Pinkish gray, stem scabrous. 13. *H. scabripes.*
        - Brownish.
          - Teeth not decurrent or but slightly so; pileus expanded, plane, smooth. 9. *H. laevigatum.*
          - Teeth decurrent.
            - Pileus infundibuliform, stem slender. 10. *H. infundibulum.*
            - Pileus plane or convex. 29. *H. fusipes.*
      - Pileus scaly or tomentose.
        - Plants solitary.
          - Scales thick, regularly imbricate. 12. *H. imbricatum.*
          - Scales thin, irregular, superficial. 11. *H. subsquamosum.*
        - Plants cespitose.
          - Plants confluent, stem somewhat branched. 30. *H. versipelle.*
          - Plants distinct, stem slender, flexuose. 37. *H. Fennicum.*
  - Substance of pileus tough, corky, woody, or coriaceous.
    - Surface of pileus zonate.
      - Teeth in age light colored, white to yellow. 26. *H. cyathiforme.*
      - Teeth in age dull colored, gray or brown.
        - Pileus regular, stem subcentral, substance uniform.
          - Pileus more or less infundibuliform, strigose, with a sterile margin.[*] 22. *H. zonatum.*
          - Pileus expanded, umbilicate.
            - Zonations elevated; pileus less than 4 cm. wide. 25. *H. fasciatum.*
            - Zonations not elevated; pileus more than 4 cm. wide. 23. *H. confluens.*

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[*] If obscurely zonate with the funnel more or less filled with a mass of coarse spongy substance *cf. H. scrobiculatum.*

Pileus irregular, lobed; stem eccentric; substance in two layers, the outer spongy, tomentose, the inner compact, darker. 16 *H. putidum.*
Plant zonate internally only,* not on the surface of the pileus.
Hard, woody texture throughout, at least when dried
Light colored, yellow, buff, or orange. 20. *H. aurantiacum.*
Gray to smoky; substance variegated with blue (?). 32. *H. compactum.*
Pileus composed of two layers, the lower hard, compact, continuous with stem, the upper consisting of a mass of dense felty tomentum.
Plant ferruginous, concolorous; stem covered with a felty tomentum. 19. *H. spongiosipes.*
Pileus variegated, light to dark brown, without tomentum on stem. 18. *H. ferrugineum.*
Pileus coriaceous, more or less infundibuliform, the surface rugose or broken up into a coarse spongy mass.
Color brown. 21. *H. scrobiculatum.*
Color ash-gray. 28. *H. canum.*
Plant azonate.
Inner substance of pileus and stem blue-black.
Surface of pileus gray, convex to plane; plant tomentose and bibulous when fresh. 15. *H. albonigrum.*
Surface of pileus buff or cream colored, concave to infundibuliform. 17. *H. suaveolens* (?).
Inner substance of pileus and stem brown to fuscous.
Spores white.
Pileus tough, corky; plant confluent, spreading, forming a crust-like mass. 14. *H. vellereum.*
Pileus coriaceous, stem slender. 40. *H. graveolens.*
Spores ferruginous or fuscous. 34. *H. mirabile* (?).

1. HYDNUM ATRO-VIRIDE Morgan, Jour. Cin. Soc. Nat. Hist. **18**: 38. *pl. 1. f. 5.* 1895

ICON.: Morgan, *loc. cit.*

TYPE LOC.: Auburn, Ala. (Atkinson).

This species has not been reported since Atkinson discovered it in Alabama. It is a small plant, "1–2 cm. wide" and is clearly distinguished by its peculiar dark green color throughout, which is characteristic even of the spores. It is further unique in being, apparently, the only central stemmed form that grows on wood.

2. HYDNUM REPANDUM L. Sp. Pl. **2**: 1178. 1753

ICON.:† Bulliard, Herbier de la France. *pl. 172 !;* Sowerby,

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* This zonation can be observed by making a vertical section through pileus and stem.

† In this extensive list an attempt has been made to roughly indicate degree of excellence. Those followed by one ! are fair to good, those followed by two !! are unusually excellent and faithful representations, while all others are indifferent or worthless.

Eng. Fung. *pl. 176 !*; Barla, Champ. de Prov. de Nice *pl. 39. f. 1–9 !;* Sicard, Hist. nat. Champ. *pl. 58. f. 293 ;* Britzelmayer, Hym. Sudb.[*] *Hydnei f. 4;* Bolton, Geschichte *pl. 89;* Krombholz, *pl. 50. f. 1–9!;* Badham, Escul. Fung., ed. 1847, *pl. 12. f. 3* ; Badham, *op. cit.*, ed. 1863, *pl. 8. f. 3 & 4;* Bel. Champ. Tarn. *pl. 7;* Fries, Sverig. ätl. svamp. *pl. 15. !!;* Paul, Icon. des Champ. *pl. 35. f. 1–2;* Harzer, Naturg. Abb. Pilze. *pl. 23. pl. 46* (*var.*)*;* Hussey, Ill. Brit. Myc. **1** : *pl. 16 !!;* Vittadini, Desc. Fung. Mang. *pl. 25. f. 2;* Peck, Reg. Rep. **48** : *pl. 38. !;* Rep. Conn. Board Agric. **29** : *pl. 6. f. 2 !;* Cordier, Les Champ. *pl. 43 !* ; Gillet, Les Champ. *pl. 322 ;*[†] Gibson, Edible Toadstools and Mushrooms, *pl. 27 !!;* Dietrich, Forstflora, ed. 1840; **2** : *f. 187. Idem.*, ed. 1860; *pl. 291. f. 1.* Atkinson, Mushrooms, *pl. 68.*

EXSICC.: Sydow, Myc. Marchica, 2819; Rabenhorst, Fungi Eur. 803; Desmazieres, Pl. Crypt. de France, 312; Herpell, Samml. präp. Hutp. 18.

TYPE LOC.: European (Giss).

Orono, Me. (Harvey); Mt. Everett, Mass., West Goshen, Conn., New York City (Underwood); Flatbush, L. I. (Zabriskie); Sandlake, Rensselaer Co., N. Y. (Peck); Ft. Edward, N. Y. (E. C. Howe) New Jersey (Ellis); Pennsylvania (Schweinitz); Fayette, Co., W. Va. (Nuttall). It has also been reported, but specimens have not been examined, from Rhode Island (Olney, Bennett); Ohio, Kentucky (Morgan); Maryland (Banning); North Carolina (Schweinitz); South Carolina (Curtis).

This is one of our most common and widely distributed species. A fleshy, terrestrial, subcentrally stemmed plant; it is readily distinguished by its light color, pale-buff to yellow, sometimes reddish, never white. Its only slightly decurrent teeth separate it at once from *H. Washingtonianum* Ell., its color and large spores, 7–9 μ wide, separate it distinctly from *H. albidum* Pk. and from the large white southern form.

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[*] This is a wretched piece of work whether regarded from a scientific or from an artistic standpoint. It is often impossible to decide from the figures what they are intended to represent. It is especially unfortunate that Britzelmayer has in this work published many new species, whose characters, without an accurate description, are most effectually obscured.

[†] The plates of this work originally unnumbered are here numbered in accordance with the Lists of the author.

2b. HYDNUM RUFESCENS Persoon: Obs. Myc. **2**: 95. 1799

ICON.: Bolton, Geschichte *pl. 89;* Barla, Champ. de Prov. de Nice *pl. 39. f. 10–12;* Britzelmayer, Hym. Südb. *Hydnei f. 5;* Patouillard, Tab. analyt. Fung. *f. 147;* Peck, Reg. Rep. **48**: *pl. 38. f. 7–10.*

TYPE LOC.: European.

This has been reported from New England (Oakes); Maryland (Banning); Pennsylvania and North Carolina (Schweinitz).

The status of the species is doubtful and it seems best to regard it as a variety of *H. repandum* from which it appears to differ only in its more slender stem and in the reddish color of the pileus. If it can show no more marked characteristics than these it should hardly be given the dignity of a distinct species. Barla's figures, *op. cit.*, show a marked scaly imbricate pileus! Persoon in Syn. Meth. Fung. 556, says: "Pileus obsolete et subtiliter zonatus est." There seems to be no indication of either of these features in our American plant. The name itself is preoccupied by *H. rufescens* Schaeffer, Fung. Bav. et Pal. Icon. **4**: 95. *pl. 141.* 1763, which seems to be even more clearly true *H. repandum.*

3. HYDNUM ALBIDUM Peck, Bull. N. Y. State Mus. Nat. Hist. **1**: 10. 1887

ICON.: Peck, Rep. Reg. **51**: *pl. 56. f. 1–7.*

TYPE LOC.: Sandlake, Rensselaer Co., N. Y. (Peck).

The species has been reported, I believe, only from Middlebury, Vt. (Burt), since Peck first described it. It is probable that it is usually referred to *H. repandum* from which it is not readily distinguished. While characteristically a smaller plant than *H. repandum* (2–3 cm. broad), specimens of the latter are often found equally as small. When fresh, its white color should distinguish it, but in the dried state the color resembles that of *H. repandum* too closely to be distinguished. The most certain distinction seems to be in the spores which are about half the size of those of *H. repandum*, being from 3.5 μ to 5.5 μ wide, but in form they are very similar. Careful field observation of this plant is very desirable.

4. **Hydnum albo-magnum** sp. nov.

A low broad fleshy plant "white throughout, then turning yellowish." Pileus even, glabrous, repand, 5–8 cm. wide; substance fleshy, brittle, white; stem short, thick, central, or excentric, 2–4 cm. high, 1–2.5 cm. thick, expanding into a thick base; teeth slender, 2–4 mm. long, slightly decurrent: spores somewhat irregular but distinctly oval, apiculate, small, 3.5–4 μ by 5.5–7 μ.

TYPE LOC.: Auburn, Ala. (Earle).

The plant, while closely related to *H. repandum* and *H. albidum*, seems to be readily distinguished from the former by its white color, glabrous pileus, and small oval spores; from the latter it is separated by its much larger size, stouter stem, and oval form of spores. The above description is based entirely on dried specimens and needs to be confirmed by comparison with the living plant.

5. HYDNUM WASHINGTONIANUM Ell. & Everh. Proc. Phila. Acad. 1894: 323. 1894

TYPE LOC.: Tracyton, Wash. (Parker).

This plant has not been reported since it was found by Miss Parker. It resembles *H. repandum* but the teeth are decurrent half way down the stem and the "substance tougher."

6. HYDNUM CAESPITOSUM Banning; Peck, Reg. Rep. **44**: 74. 1891

ICON.: Banning, Fungi of Maryland, *pl. 137.*[*]

TYPE LOC.: Carroll Co., Md. (Banning).

The plant has not been reported by any one but Miss Banning. Her description as quoted by Peck, *loc. cit.*, is too brief to be very satisfactory but is materially supplemented by her plate. The plant, which appears to be closely related to *H. repandum*, seems to differ from that species, especially in the round, thick, convex, nearly hemispherical pileus, the proportionately thickened stem, equal to a third or a half the diameter of the pileus, and in the flesh turning yellow when cut.

7. HYDNUM DIFFRACTUM Berk. Lond. Jour. Bot. **6**: 323. 1847

TYPE LOC.: Waynesville, O. (Lea).

Since its original discovery by T. G. Lea, this plant has been reported only by A. P. Morgan from Kentucky and Ohio. I have not seen an unquestionable specimen of it and am in doubt as to its true character. As this is a strictly American plant and seems to be well characterized, it is desirable that it should be better known and better represented in our herbaria, especially considering that it is now over fifty years since it was first described by Berkeley, and yet in that time only two specimens of it have ever been reported. As the original description will not be readily accessible to many, I add it in part for the purpose of assisting in the identification of the plant.

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[*] This is a work in manuscript deposited in the N. Y. State Herbarium at Albany.

" Pileus 3 inches broad, convex smooth, of a tough, fleshy substance, at length much cracked and split, margin involute. Stem 1½–2 inches high, ¾ of an inch or more thick, buff, and split like the pileus, tender when fresh. Spines even, subulate, entire, soft, of a pale buff. Smell vinous. A remarkable rigid species when dry."

"Allied to *H. candidum* and *H. repandum*." Lond. Jour. Bot. **6**: 323. 1847.

It is to be hoped that collectors, especially in Ohio, will watch closely for this interesting plant.

8. HYDNUM CURTISII Berk. Grevillea, **1**: 71. 1872

TYPE LOC.: South Carolina (Curtis).

The plant does not seem to be readily distinguished from *H. levigatum* especially in view of the uncertainties connected with the latter. The chief distinctions seem to be the smaller size, less than 5 cm. wide, with the stem attenuate upward from a bulbous base.

It has never been reported since its discovery, but a plant found by Earle in Alabama and now in the Underwood Herbarium has been referred here. It appears to conform fairly well to the description but the latter is too meager to be entirely satisfactory.

9. HYDNUM LEVIGATUM Swartz, Kongl. vet. Acad. nya handl. 1810: 243. 1810

ICON: Fries, Sverig. ätl. Svamp. *pl. 81!*. Barla, Champ. Prov. de Nice *pl. 38. f. 5, 6* (?); Bresadola, Fung. Trid. *pl. 138* (?).

TYPE LOC.: European.

New Jersey (Gentry). Reported also from Pennsylvania (Schweinitz) and North Carolina (Curtis). The Schweinitzian specimen now in the Philadelphia Academy of Science is nearly destroyed so that its characters can not be determined. Curtis' specimen I have not seen. It seems doubtful if the plant is common with us. Most of the specimens referred here in the collections are evidently something quite different. I have seen but one specimen (Gentry's) that appeared to have just claim to being regarded as this species.

There seems to be no little uncertainty among authors concerning this plant. Descriptions vary greatly; Barla's figure seems to depict a very different plant from Swartz' and Bresadola's figure is doubtful. The chief distinctive characteristic of the plant is the thick, fleshy, *regular*, *glabrous* pileus, 5–15 cm. wide, by no means repand. Saccardo says, "spores 10–15 μ long."

In view of the uncertainty that seems to prevail concerning this plant and as Swartz's original description is often inaccessible, it is quoted in full.

"*H. laevigatum*, pileo carnoso convexo castaneo laevi, aculeis mollibus albido-cinereis; stipite inaequali elongato. Erinaceus obscure ferrugineus, subtus denticulis, longioribus cinereis. *Stipes* 2–3 pollicatis, teretiusculus inaequalis saepe tortuosus sulcatus, solidus, carnosus, pallidus, crassitie digiti minoris. *Pileus* diam sub 2 pollic. et ultra, modice convexus, centro disci rarius depresso, margine deflexus, carnosus laevis nec squamosus, medio subinde rimosus, fragilis, pallide castaneus l. ferrugineus. *Caro* albescens. *Aculei* numerosissimi, longiusculi subulati, albido-cinerei, fragilissimi, molles."*

10. HYDNUM INFUNDIBULUM Swartz. Kongl. vet. Acad. nya handl. 1810: 244. 1810

ICON.: Svensk. Bot. *pl. 492.*†

TYPE LOC.: European.

Reported from Pennsylvania (Schweinitz); Ohio (Lea, Morgan); Kentucky (Morgan). Schweinitz's specimen in the Philadelphia Academy of sciences is nearly destroyed; what remains rather suggests *H. scrobiculatum.* The Ohio specimens have not been seen. Morgan's Kentucky specimens answer well to the descriptions of *H. infundibulum* except as to size. The European plant is described as 20 cm. wide and with stem 5–8 cm. long and 3 cm. thick. Morgan's specimens are 4–7 cm. wide with stem 4–5 cm. long, a much smaller plant. The plant is distinguished by its infundibuliform pileus, with erect flexuose, plicate margin.

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* Kongl. Vetenskaps Acad. nya Handlingar 1810: 243.

† This work has not been seen but as it is the only place where this plant is supposed to be figured it is quoted as above.

11. HYDNUM SUBSQUAMOSUM Batsch, Elench. Fung. 111. 1783

ICON.: Batsch, Elench Fung. *f. 43!.* Paulet, Icon. Dec. Champ. *pl. 33. f. 1;* the latter simply a copy of Batsch.

TYPE LOC.: European.

Reported from Rhode Island (Bennett); Pennsylvania (Schweinitz); South Carolina (Schweinitz, Curtis, Ravenel). Bennett's Rhode Island specimen is unquestionably *H. scrobiculatum* and therefore must be excluded. Schweinitz's specimen is doubtful, the others have not been seen. Schweinitz's Pennsylvania specimen is identical with a specimen in the Underwood herbarium referred to *H. imbricatum* and characterized by coarse aculei, a slender stem and a remarkably light porous substance to the pileus when dried. This species so far as our American forms are concerned is doubtless involved in confusion with *H. imbricatum.* A thorough investigation is greatly needed of these related species including *H. levigatum.*

12. HYDNUM IMBRICATUM L. Sp. Pl. **2**: 1178. 1753

ICON.: Schaeffer, Fung. Bav. et Pal. Icon. *pl. 140;* Sowerby, Eng. Fung. *pl. 73;* Bolton, Geschichte *pl. 88;* Barla, Champ. de Prov. de Nice *pl. 38. f. 1–4;* Fl. Dan. *pl. 176*; Harzer, Naturg. Abb. Pilze *pl. 3. f. 6–9;* Fries Sverig. ätl. Svamp. *pl. 33;* Gautier, Champ. *pl. 1. f. 3;* Pat. Tab. analyt. Fung. *pl. 245;* Richon and Rose, Atlas Champ. *pl. 65. f. 8–11;* Greville, Scot. Crypt. Flor. *pl. 71;* Atkinson, Mushrooms, *f. 189.*

EXSICC.: Krieger Fung. Sax. 419; Linhart, Fung. Hung. 347; Roumeguere, Fung. Select. 5328; Roumeguere, Fung. Gall. 2310; Sydow, Myc. March. 105; Ellis, N. Am. Fung. 926;* Herpell; Samml. präp. Hutp. 75.

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* In one set of N. A. F. under this number there was found a most typical specimen of what I regard as *H. imbricatum*, in another set under the same number the specimen appears to be a very distinct thing and entitled to be treated as a different species.

TYPE LOC.: European.

Reported from Massachusetts (Seymour); New Jersey (Ellis); Montana (Tweedy); New York (Peck); Rhode Island (Bennett); Pennsylvania (Schweinitz); Maryland (Banning); West Virginia (Nuttall); South Carolina (Schweinitz); Ohio (Lloyd); Kentucky (Morgan). This distribution can be regarded only as provisional as the specimens are found, so far as examined, to vary too greatly among themselves. For example, Tweedy's Montana specimen is a gray-brown plant with the pileus broken up into large, thick, imbricate plates, while Morgan's Kentucky plant is yellowish-brown with the pileus covered with numerous fine thin scales. There seems to have been a disposition among collectors to refer everything with a scaly pileus to this species. It seems probable, however, that we have several distinct species masquerading under this name. It is especially desirable that careful observations should be made of fresh specimens of this plant, with reference to the character of the scales, size, arrangement, and structure; also as to the teeth, length, size, color, and whether closely set or not; in addition to the usual points to be observed in the fleshy fungi.

13. HYDNUM SCABRIPES Peck, Reg. Rep. **48**: 13. 1896

TYPE LOC.: Elizabethtown, N. Y. (Peck).

The plant has not been reported since its first discovery by Peck. It is a very peculiar and well-marked species, large and conspicuous, with pileus 9–12 cm. broad, pinkish gray in color; teeth decurrent; stem 9–12 cm. long, scabrous-dotted.

14. HYDNUM VELLEREUM Peck, Reg. Rep. **50**: 110. 1897

TYPE LOC.: Port Jefferson, N. Y. (Peck).

This plant has been found also in Rensselaer Co., N. Y. by the writer. It forms shapeless crusts spread over the substratum of fallen leaves and often assumes nearly a resupinate character. It somewhat resembles *H. albonigrum* but is dryer in substance in the fresh condition and the color of the interior is much lighter, ashy-gray or brownish. It appears to grow in dryer situations than the former plant. Both species emit a strong heavy odor in drying which lasts for months. In *H. vellereum* this odor is quite suggestive of slippery elm.

15. HYDNUM ALBONIGRUM Peck, Reg. Rep. **50** : 110. 1897

TYPE LOC. : Gansevoort, N. Y. (Peck).

Massachusetts (Vail); Moravia, N. Y. (Banker). The plant is readily distinguished by its hard, nearly black central portion surrounded by a spongy-tomentose structure similar to *H. spongiosipes* but color gray-black and teeth white. When fresh this tomentose portion is tumid with water which can be readily squeezed out in drops. The plant grows among fallen leaves in wet springy situations. In drying it emits a heavy odor suggestive of certain fertilizing phosphates. It seems to be closely related to *H. vellereum*, with which it should be compared.

16. HYDNUM PUTIDUM Atkinson, Mushrooms, Edible, Poisonous, etc. 199. *pl. 69. f. 188.* 1900

TYPE LOC.: Blowing Rock, N. C. (Atkinson).

No specimens of this species have been examined but from Atkinson's plate and description it appears to be closely related to the above *H. albonigrum* Pk. from which it is evidently clearly separated by its larger size, "8–12 cm. broad," and by its "prominent concentric zones." The plant is further described as "remarkable for its peculiar odor, resembling, when fresh, that of an Ethiopian ; for its tough, zonate pileus with a prominent white edge, and the stout irregular stem, resembling the stem of *Hydnum velutinum*,* with a thick, spongy, outer layer and a central hard core."

It is worthy of note that we evidently have here a group of closely related species that are especially characterized by the possession of a "peculiar odor." It is unfortunate that odors are so difficult to describe. It may be further noted that we also have in this genus a group of species marked by a peculiar double character in the internal structure, consisting of a thick, spongy or tomentose outer layer and a central hard compact portion.

17. HYDNUM SUAVEOLENS Scop. Fl. Carn. **2**: 472. 1772

TYPE LOC.: European.

Ft. Edward, N. Y. (E. C. Howe); Sandlake, N. Y. (Peck); Kentucky (Morgan) ; Connecticut (Underwood); New Jersey (Ellis).

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* This probably refers to the species recognized in this paper as *H. spongiosipes* Pk.

Although this plant has been quite largely reported it seems doubtful if the true *H. suaveolens* of Scopoli has ever been found in this country. This notice of it would, therefore, have been placed with the *Species dubiae*, but that in the collections a plant with uniform characteristics is quite generally found referred to this species. Unless this plant undergoes considerable change in drying it does not appear to possess the characteristic blue color so strongly emphasized in the descriptions of *H. suaveolens* Scop. In many ways the American plant seems closely related to *H albonigrum* Pk. and *H. vellereum* Pk., differing from the former chiefly in the lighter color of the interior (not black) and in the cream colored or buff surface of the pileus. It differs from the latter in the darker color of the interior, and in its buff pileus; it is also more regularly mesopus in form. In fact it appears in many of its features to be intermediate between *H. albonigrum* and *H. vellereum* and is specifically distinguished by its cream colored pileus.

It is very desirable that accurate observations should be made on this plant in its fresh state, and its true position definitely determined.

18. HYDNUM FERRUGINEUM Fries,* Obs. Myc. **1**: 133. 1815

ICON.: Fries Icon. Select. Hym. *pl. 4;* Krombholz. *pl. 50. f. 10, 11.*

Bresadola Fung. Trid. *pl. 143;* Bulliard, Herbier de la France *pl. 409* are cited under this name, but they do not represent *H. ferrugineum* Fr. Bresadola's figure may be possibly *H. scrobiculatum.*

EXSICC.: Roumeguere, Fung. Gall. 2308; Desmazieres, Pl. Crypt. de France 2159 (?); Ravenel, Fung. Amer. 433;† Ravenel, Fung. Car. **3**: 17.‡ Exsiccati appear to furnish no satisfactory information on this species.

TYPE LOC: European.

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* Fries's name for this plant is excluded by *H. ferrugineum* Pers. Tent. Disp. Meth. Fung. 30. 1797, which was given to a resupinate species. It should be known as *H. carbunculus* Secretan, Myc. Suisse, **2**: 515. 1833.

† In the set examined the specimens are uncertain and of little value.

‡ The specimen under this number in the set examined is not *H. ferrugineum* Fr. but is a peculiar brick red plant that has been quite generally referred here. It seems probable that it is an undescribed species.

This plant has also been reported from Alabama (Earle); New Jersey (Ellis); South Carolina (Ravenel); Pennsylvania (Schweinitz); North Carolina (Curtis); Florida (Lloyd); Ohio (Lloyd). I have not seen the last three and as to the others, several are evidently the brick red species of Ravenel, while Schweinitz's plant appears to be the same as *H. spongiosipes* Pk. Earle's Alabama plant appears to correspond closely to Fries's description and figure. *H. ferrugineum* Fr. would seem to be positively distinguished by the unique blood-red drops that gather on the pileus and which in drying leave a dark varnished coating on the plant.

19. HYDNUM SPONGIOSIPES Peck, Reg. Rep. **50**: 111. 1897

TYPE LOC.: Round Lake, N. Y. (Peck); New Jersey (Ellis); Ohio (Morgan); Iowa (McBride); Alabama (Atkinson). This plant has been uniformly reported as *H. velutinum* Fr. but Peck is undoubtedly correct in describing it as a distinct species. The hard central portion distinct from the spongy-tomentose exterior both of stem and pileus gives a marked character to the plant. Uniform cinnamon brown throughout, the pileus 3–10 cm. broad.

20. HYDNUM AURANTIACUM (Batsch) A. & S. Conspectus Fung. Nisk. 265. 1805

ICON.: Batsch, Elench. Fung. **2**: *pl. 40. f. 222!;* Bresadola Fung. Trid. *pl. 142.*

EXSICC.: Roumeguere, Fung. Select. 5329 and 6635; Sydow, Myc. March. 811. The latter is somewhat doubtful.

TYPE LOC.: European.

New York (Underwood); New Jersey (Ellis); Alabama (Earle); Pennsylvania (Schweinitz). Also reported, but the specimens not seen from: New England (Sprague); South Carolina (Curtis); Rhode Island (Bennett). This species is well marked by its woody texture and bright orange color, which is quite permanent in the interior, but varies considerably on the exterior. There is little doubt that the plant should be known as *H. floriforme* Schaeffer, Fung. Bav. et Pal. Icon. **4**: 97. *pl. 146. f. 1–6.* 1774. Both figures and description correspond well to this plant. Persoon in Commentarius 57. 1800, identified Schaeffer's figures with *H. suberosum* var. *β aurantiacum* Batsch, and named the plant *H. hybridum.* Fries, likewise, regarded these figures of Schaeffer as representing *H. aurantiacum* Sys. Myc. **1** : 403. 1821.

I have seen specimens of the plant with the same turbinate pileus as shown in part of Schaeffer's figures though the more common form appears to be the concave or infundibuliform pileus shown in others of his figures. That the two forms should be treated as distinct species, as was done by Persoon, seems very doubtful.

21. HYDNUM SCROBICULATUM Fries, Obs. Myc. **1** : 143. 1815

ICON. : Fries, Icon. Select. Hym. *pl. 5. f. 1!!* ; Britzelmayer, Hym. Südb. *Hydnei f. 8.*

EXSICC. : Romell, Fung. Scand. 19; Roumeguere, Fung. Gall. 3007, 3626.

New York (Cushier); New Jersey (Ellis); Rhode Island (Bennett). The last reported as *H. subsquamosum.*

The plant is closely related to *H. zonatum* Batsch, from which it is difficult to separate it absolutely. The more typical forms have the surface of the pileus roughened and broken up into a coarse, spongy or scaly mass. But in other forms this feature becomes a mere roughening of the surface which also appears obscurely zonate, thus forming an easy transition to *H. zonatum.*

22. HYDNUM ZONATUM Batsch, Elench. Fung. 111. 1783

Icon. : Batsch, Elench. Fung. **2** : *pl. 40. f. 224 a, b, c !*; Nees, Sys. Pilz. *pl. 32. f. 242.* *

EXSICC. : Ravenel, Fung. Car. **1**: 25.

TYPE LOC. : European.

Connecticut (Underwood); Rhode Island (Bennett); New Jersey (Ellis); South Carolina (Ravenel); Ohio and Kentucky (Morgan); Alabama (Underwood). Specimens also reported but not examined from Florida (Calkins).

The typical form of this species is clearly marked and readily recognized by its infundibuliform, coriaceus pileus, with several sharply defined zones, by its soft cinnamon brown color, and by its sterile margin, which does not curl in drying. But from this it varies in numerous ways forming intermediate series that connect it so closely with other species, particularly *H. scrobiculatum*, that it is very difficult to say where the line should be drawn between them. The plant should receive careful field study, and its variations noted, especially in single gatherings, where there is reason to believe the plants have all sprung from a common mycelium.

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* This is of no value. α and β are mere copies of Schaeffer's figure of *cyathiforme*, while B is a copy of Batsch.

23. HYDNUM CONFLUENS Peck, Reg. Rep. **26**: 71. 1874

TYPE LOC.: New Scotland, N. Y. (Peck).

The plant has not been reported by any but its discoverer. "Pileus thin, tough, expanded, sometimes confluent, hygrophanous; stem surrounded below by a dense myceloid tomentum." Pileus 5–8 cm. wide. This is not the same as *H. concrescens* var. *confluens* Pers. Myc. Eur. **2**: 165. 1825 so that the present name cannot hold.

24. HYDNUM CORIACEO-MEMBRANACEUM Schweinitz, Syn. N. A. Fung. 162. 1834

TYPE LOC.: Bethlehem, Pa. (Schweinitz).

This plant has never been reported since Schweinitz described it. The type specimen in the Schweinitz collection in the Philadelphia Academy of Science is unfortunately totally destroyed Berkeley and Curtis, who saw the specimen in 1855, reported that it was "a very singular and distinct species" in their commmentary on the Syn. Fung. Amer. Bor.* Schweinitz himself remarks "distinctissima species." It would be especially interesting if this apparently clearly marked species could be rediscovered. The original description is added, therefore, as it is not generally accessible.

"Pileis concrescentibus, lato-repandis, subinfundibuliformibus, coriaceo-membranaceis, exacte *Polypori versicoloris* substantia in varietati ejusdem membranacei ceterum glabris, strigoso-zonatis margine strigoso fimbriatis, saepe laceratis, 1–2 uncialibus diametro, pallide cervinis. Subulis sparsis, subulatis, longis saepe tortis, lutescentibus. Stipitibus tenuibus, centralibus, brevibus, concrescentibus." Syn. N. A. Fung. 162. 1834.

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* Jour. Acad. Sci. Phila. II. **3**: 215. 1855.

25. HYDNUM FASCIATUM Peck, Reg. Rep. **41** : 78. 1888

TYPE LOC. : Catskill Mts., N. Y. (Peck).

The species has been reported only by its discoverer. It is a very distinct and beautiful species. "Pileus thin, coriaceous, nearly plane, umbilicate, blackish-brown, adorned with three to seven narrow elevated scabrous tawny-gray concentric zones," 1.5–2.5 cm. wide.

26. HYDNUM CYATHIFORME Schaeff. Fung. Bav. et Pal. **4** : 93. 1763

ICON. : Schaeffer, Fung. Bav. et Pal. Icon. *pl. 139 ! !.*

Bulliard, Herbier de la France *pl. 156 ?* Flor. Dan. *pl. 1020. f. 2 ?* Harzer, Naturg. Abb. Pilze *pl. 3. f. 1–5 ?* Sicard, Hist. Nat. Champ. *pl. 58. f. 294 ?* Britzelmayer, Hym. Südb. *Hydnei f. 9 ?* Schaeffer's figures are clearly marked and readily identify the plant, the others are all doubtful and most of them appear to represent a totally different plant.

EXSICC. : Krieger, Fung. Sax. 906 ; Sydow, Myc. March. 206 and 1011 ; De Thümen, Myc. Univ. 207 ;* Rabenhorst, Fung. Eur. 611* and 2304 ;* Herpell, Samml. präp. Hutp. 115 ; Roumeguere, Fung. Gall. 2306.†

TYPE LOC. : European.

New Hampshire (Minns) ; Connecticut (Underwood). It has also been reported but specimens not seen from Rhode Island (Bennett) and California (Harkness). The Schweinitzian specimens reported from South Carolina and Pennsylvania are not *H. cyathiforme* Schaef. but appear intermediate between *scrobiculatum* and *zonatum*, having the fertile curling margin of the former but the distinct zonations of the latter. The specimens are marked "(H. scrobiculatum) Epic. 21. Hydnum cyathiforme Bull."

H. cyathiforme Schaeff. is often regarded as a synonym of *H. tomentosum* L. (see De Thümen and Rabenhorst above). But for the present it seems best to follow Fries in keeping them distinct, although, I admit, the reason for doing this is chiefly the fact that Linnaeus's two-line description is not sufficient to identify anything, while Schaeffer's plant is readily recognized from his figure and is clearly characterized by the white or cream colored teeth, the darker zonate pileus, somewhat tomentose at the center, and with margin the color of the teeth. The pilei are frequently confluent, forming a thin expanded crust supported by the slender distinct stems.

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* These specimens are marked *H. tomentosum* L. but are typical plants of *H. cyathiforme* Schaeff.

† Roumeguere's specimens are practically worthless for critical purposes.

27. HYDNUM DELICATUM Schweinitz, Syn. N. A. Fung. 161. 1832.
Not *H. delicatum* Klotsch.

TYPE LOC.: Bethlehem, Pa. (Schweinitz).

This species has not been reported except by its discoverer. The type specimen in the Schweinitz collection at Philadelphia is partly destroyed, but sufficient remains to show the chief characters of the plant. It is a very dainty little species, 1.5–2 cm. high, ash-gray in color; pileus thin, flat to infundibuliform; stem attenuate to the base. A plant in the Ellis collection at the N. Y. Botanical Garden marked *H. suffocatum* is to all appearances this species and so gives another station, Newfield, N. J.

28. HYDNUM CANUM Schweinitz, Syn. Fung. Car. 77. 1818

TYPE LOC.: North Carolina (Schweinitz).

Also reported from Bethlehem, Pa. (Schweinitz).

The species has never been reported by any other than Schweinitz himself. His description is too brief to convey any definite idea of the species. Fries regarded the plant the same as *H. gracile* with a confidence that would indicate he had seen something more than Schweinitz's three-line description. The specimen in the Schweinitz collection at Philadelphia, while not very satisfactory, appears to be a plant closely resembling *H. scrobiculatum* in all important features except that the color is ash-gray.

SPECIES DUBIAE

29. HYDNUM FUSIPES Pers. Myc. Eur. **2**: 162. 1825

ICON.: Pers. *op. cit. pl. 20. f. 4–6.*

TYPE LOC.: European.

Bethlehem, Pennsylvania (Schweinitz). Has never been reported except by Schweinitz. His specimen as preserved in the Philadelphia Acad. of Sci. does not in the least resemble Persoon's figure and appears to be an immature plant of some sort. The decidedly decurrent teeth would seem to distinguish the species well and it is doubtful if it has ever been found in this country.

30. HYDNUM VERSIPELLE Fries, Ofvers. af Kongl. Vet. Ak. Förhand. 1861 : 73. 1862

ICON.: Fries, Icon. Select. Hym. *pl. 1 !.*

TYPE LOC.: European.

This species has been reported but once. New York (Fairman). I have seen only a single specimen of this collection but doubt if it is *H. versipelle.* The plant seen does not show in the least the confluent cespitose character emphasized by Fries both in his description and in his figure.

31. HYDNUM TOMENTOSUM L. Sp. Pl. **2** : 1178. 1753

ICON.: Smith, Seeman's Jour. Bot. **6** : *pl. 76.*

TYPE LOC.: European.

This has been reported only by Schweinitz. His specimen in the Philadelphia Academy is now only a scrap but is clearly not *cyathiforme* Schaef. nor does it resemble *H. tomentosum* L. as figured by Smith, *loc. cit.* It seems safe to assume that *H. tomentosum* L., if we are to regard it as distinct from *H. cyathiforme* Schaeff., has not been found in this country.

32. HYDNUM COMPACTUM Persoon, Comm. Schaeff. 57. *pl. 146. f. 1, 2, 3, 5, 6.* 1800

TYPE LOC.: European.

Reported from South Carolina (Curtis) and North Carolina (Schweinitz). No species of the genus seems to be more uncertain than this. An examination of specimens from collectors in this country, as well as a study of European exciccati, reveals a very great difference of conception as to the characters of the species; even published descriptions are difficult to harmonize. An appeal to Persoon's original description does not give much help in the matter. He established the species on part of Schaeffer's figures of *H. floriforme,* the turbinate forms of *pl. 146. f. 1, 2, 3, 5, 6,* and gave a very meager description, but one that differs essentially from Schaeffer's account of *floriforme.* As there is no good reason to suppose Schaeffer's figures did not correctly represent the plant he described, we are left not only in doubt, but in some confusion as to what plant Persoon may have had in mind. A plant from Alabama, in the Underwood collection, conforms quite closely to Persoon's description and resembles in form Schaeffer's figures, but does not correspond to any known European plant. It is doubtful, therefore, whether it should be regarded as *H. compactum* Pers. Moreover, it does not show the blue variegations mentioned by Fries, a characteristic which is quite evident in some of the European specimens. I have not seen Curtis's specimens, while Schweinitz's plant as preserved at Philadelphia is very curious and distinct from anything I have seen. I believe we have several unique species in this country passing under the name of *H. compactum.*

33. HYDNUM CINEREUM Bull. Herbier de la France, 309. 1791

ICON.: Bulliard Herbier de la France, *pl. 419 !;* Sicard, Hist. nat. Champ. *pl. 58. f. 297.*

TYPE LOC.: European.

Bethlehem, Pa. (Schweinitz). Has been reported only by Schweinitz and his specimen is too uncertain to draw any conclusions. In the absence of actual specimens it is impossible to satisfactorily locate this plant. It is doubtful if this species has really been found here.

34. HYDNUM MIRABILE Fries, Monog. **2**: 349. 1863

ICON.: Fries, Icon. Select. Hym. *pl. 3. f. 2 !.*

TYPE LOC.: European.

Port Jefferson, N. Y. (Peck). This species has been reported only by Peck and he expresses doubt as to whether his specimen is rightly referred here. The plant is characterized by a peculiar woolly tomentum covering the entire plant.

35. HYDNUM VELUTINUM Fries, Sys. Myc. **1**: 404. 1821

ICON.: Bulliard, Herbier de la France *pl. 453. f. 2.*

TYPE LOC.: European.

All specimens reported as *H. velutinum* that have been examined have proven to be *H. spongiosipes* and it is probable that the latter species has been generally referred to *velutinum.* Curtis's North Carolina specimen has not been seen.

36. HYDNUM CONCRESCENS Persoon, Obs. Myc. **1**: 74. 1796

TYPE LOC.: European.

North Carolina (Schweinitz).

Schweinitz is the only one who has reported a species under this name. Later in his Syn. N. A. Fung. 161 he referred the same plant to *H. cyathiforme* Fr. As *H. concrescens* Pers. is a doubtful species, and Fries himself afterward repudiated his own *H. cyathiforme* it is difficult to say what Schweinitz's plant may have been. There is no specimen in his collection at Philadelphia.

37. HYDNUM FENNICUM Karst. Rev. Myc. **9**: 10. 1887

TYPE LOC.: European.

Port Jefferson, N. Y. (Peck); Kentucky (Morgan).

The American plants referred to this species are somewhat doubtful but correspond closely to a specimen from Karsten himself which is preserved in the New York Botanical Garden. The plant appears to be especially marked by a dark blue color at the base of the stem.

38. HYDNUM SPADICEUM Persoon, Icon. et Disc. 34. 1798

ICON.: Persoon, *op. cit. pl. 9. f. 1.*

TYPE LOC.: European.

Reported from Rhode Island (Bennett) and North Carolina (Schweinitz). Schweinitz afterward regarded his specimen as *H. connatum* and Bennett's plant appears to have been destroyed.

39. HYDNUM CONNATUM Schultz, Prodr. Flor. Starg. 491. 1806

TYPE LOC.: European.

Reported from North Carolina (Schweinitz). The specimen in the Acad. Nat. Sci. Phila. does not seem to differ from *H. scrobiculatum.*

40. HYDNUM GRAVEOLENS Delast.; Fries Epic 509. 1836–38

ICON.: Fries, Icon. Select. Hym. *pl. 6. f. 1!.*

EXSICC.: Ravenel, Fung. Car. **3**: 16; Sydow, Myc. March. 908: Roumeguere, Fung. Select. 6241; Roumeguere, Fung. Gall. 2007; Rabenhorst, Fung. Eur. 1104.

TYPE LOC.: European.

Reported also from Ft. Edward, N. Y. (E. C. Howe) and North Carolina (Curtis). I have not seen these specimens. The exsiccati quoted above furnish little information regarding this species ; the American collections are of uncertain relations and it seems doubtful if the species has ever really been found in this country. Such specimens as I have been able to examine do not satisfy me as corresponding either to Fries' figure or description.

DICKINSON SEMINARY, WILLIAMSPORT, PA. March, 1901.